SPACE EXPLORATION

Science for the 21st Century will include still more advances from exploration of the solar system and beyond

Los Alamos has a venerable tradition of exploring the cosmos. Detectors aboard the Vela satellites launched in the 1960s and '70s to look for nuclear weapons treaty violations provided scientists their first glimpse of gamma ray bursts, flashes that arise from colossal explosions at the farthest reaches of the universe. Today, that astrophysical exploration continues through a wide-field X-ray monitor Los Alamos developed for the international High-Energy Transient Experiment satellite, the first multi-wavelength study of these still-enigmatic outbursts.

On the ground, Los Alamos has joined with other institutions to develop small, rapid-response telescopes that can in seconds optically track GRBs and other celestial outbursts detected by satellites. These systems will be operated at a fledgling observatory in the Jemez Mountains near Los Alamos that already boasts a six-million-gallon, water-filled "telescope" that captures signs of cosmic rays and gamma rays.

Vela also started Los Alamos on studies of the solar wind and Earth's magnetosphere with significant discoveries in both regimes. Los Alamos has since flown instruments aboard numerous spacecraft criss-crossing the solar system. These have provided detailed insight into the ebb and flow of energy carried in the solar wind, a million-mile-per-hour outflow of particles that fills a tenuous cocoon surrounding and interacting with all the planets.

A series of craft under the International Monitoring Program provided early views of the solar wind and one, IMP-8, still sends data today nearly 30 years after launch. Los Alamos currently gathers key solar wind data from NASA's Advanced Composition Explorer, which is parked at a gravitationally stable point between Earth and Sun, and from the international Ulysses mission, which is circling on the first-ever swing over the poles of the sun. Los Alamos also is a key contributor to Genesis, a NASA mission that will capture particles of the wind and return them to Earth – the first samples of the Sun ever studied in laboratories.

Two Los Alamos instruments for measuring ions in space plasmas — one a completely new design for space studies — are racing toward Saturn on NASA's Cassini craft, due to arrive in 2004. Los Alamos scientists have advanced their innovative design still more, developing a small, highly efficient ion mass spectrometer that flew on a low-cost NASA mission for demonstrating innovative new technologies.

Satellites orbiting Earth also carry Los Alamos detectors seeking clandestine nuclear weapons development. These also study the charged particles trapped by our planet's magnetic field. A new technique – neutral atom imaging – has been used in recent years to track "space storms" and other disturbances in the magnetosphere. This technique will see its next advance on the upcoming IMAGE mission and later on TWINS, two satellites set for launch in 2003 and 2004. TWINS will provide the first stereoscopic views of the magnetosphere and the sharpest look yet at Earth's space weather.

Los Alamos played a key role in NASA's Lunar Prospector mission. Los Alamos' neutron detector provided evidence of frozen water at the lunar poles. A gamma ray detector provided detailed maps of the Moon's surface geology. Similar instruments are slated for future Mars' missions.

Still in development are laser systems that can be used to study the composition of planets or asteroids from afar, advanced drilling technology for piercing the rock and ice of planets or moons, and innovative analytical methods for spotting ancient traces of life.

Los Alamos technology will continue to provide new views and understandings of our local corner of space as we move into the 21st Century.

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